

**REMARKS**

The above amendments area submitted to place the specification and claims in substantially the same condition as to the specification and claims which have been amended under Article 34 in the international application. A copy of the amendments dated August 4, 2004 and December 13, 2004 are enclosed. Early and favorable action is awaited.

In the event that any fees are due in connection with this paper, please charge our Deposit Account No. 01-2340.

Respectfully submitted,

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prevented, molding at high speed is possible and a heat generating body after molding has an excellent exothermic character and also to provide a heat generating body using the same.

#### Disclosure of the Invention

The present inventors have repeatedly conducted intensive studies for solving the above-mentioned problems and found that, when particle size of solid components and excessive water in a heat generating composition are made within appropriate ranges, heat generation is achieved without removal of water using a water-absorptive material or the like after molding, molding property, shape-holding property and exothermic characteristic are able to be highly maintained and a warming effect is achieved for a long period.

Thus, a heat generating composition of the invention is as mentioned in claim 1 that, in a heat generating composition which generates heat by contacting with air, a heat generating composition which is characterized in that an exothermic substance, a reaction promoter, water and a carbon component are essential components, water mobility value thereof is 5 to 15, maximum particle size of water-insoluble solid components excluding the reaction promoter and water is 1 mm or less where 80% or more thereof has a particle size of 300  $\mu\text{m}$  or less, water in the heat generating composition does not

function as a barrier layer, the heat generating composition has molding property by water and exothermic reaction takes place when contacted to the air.

The heat generating composition mentioned in claim 2 is that according to claim 1, wherein particle size of all of the above water-insoluble solid components is 300  $\mu\text{m}$  or less.

The heat generating composition mentioned in claim 3 is that according to claim 1, wherein the heat generating composition uses a heat generating composition having a water mobility value of 7 or more as a material and water content is adjusted by a non-oxidative gas.

The heat generating composition mentioned in claim 4 is that according to claim 1, wherein the heat generating composition contains at least one member selected from additional components consisting of water-retaining agent, water-absorptive polymer, hydrogen formation inhibitor, pH adjusting agent, surfactant, antifoaming agent, hydrophobic polymer compound, pyroelectric substance, far-infrared ray-radiating substance, negative ion-generating agent, ~~antioxidant~~, aggregate, heat generating aid, oxidation catalyst, organosilicon compound, fibrous material, sanitary agent, fertilizer component, ~~active aromatic compound~~, ~~inactive aromatic compound~~, moisturizer and a mixture thereof.

A heat generating body mentioned in claim 5 is characterized in that at least a part of the heat generating

## Claims

1. In a heat generating composition which generates heat by contacting with air, a heat generating composition which is characterized in that an exothermic substance, a reaction promoter, water and a carbon component are essential components, water mobility value thereof is 5 to 15, maximum particle size of water-insoluble solid components excluding the reaction promoter and water is 1 mm or less where 80% or more thereof has a particle size of 300  $\mu\text{m}$  or less, water in the heat generating composition does not function as a barrier layer, the heat generating composition has molding property by water and exothermic reaction takes place when contacted to the air.

2. The heat generating composition according to claim 1, wherein particle size of all of the above water-insoluble solid components is 300  $\mu\text{m}$  or less.

3. The heat generating composition according to claim 1, wherein the heat generating composition uses a heat generating composition having a water mobility value of 7 or more as a material and water content is adjusted by a non-oxidative gas.

4. The heat generating composition according to claim 1, wherein the heat generating composition contains at least one member selected from additional components consisting of water-retaining agent, water-absorptive polymer, hydrogen

formation inhibitor, pH adjusting agent, surfactant, antifoaming agent, hydrophobic polymer compound, pyroelectric substance, far-infrared ray-radiating substance, negative ion-generating agent, ~~antioxidant~~, aggregate, heat generating aid, oxidation catalyst, organosilicon compound, fibrous material, sanitary agent, fertilizer component, ~~active aromatic compound, inactive aromatic compound~~, moisturizer and a mixture thereof.

5. A heat generating body which is characterized in that at least a part of the heat generating composition mentioned in claim 1 is sealed in a container bag where at least a part thereof has air permeability.

6. The heat generating body according to claim 5, wherein the heat generating composition is layered and received in a container bag, the layered heat generating composition forms two or more plural sectional exothermic parts being separately located and an aggregated exothermic part is formed from aggregation of the sectional exothermic parts.

7. The heat generating body according to claim 6, wherein the container bag comprises a substrate material and a covering material, at least one of the substrate material and the covering material has gas permeability and each of the sectional exothermic parts is sectioned by a sectional part by means of a heat seal of the substrate material and the covering material.

prevented, molding at high speed is possible and a heat generating body after molding has an excellent exothermic character and also to provide a heat generating body using the same.

#### Disclosure of the Invention

The present inventors have repeatedly conducted intensive studies for solving the above-mentioned problems and found that, when particle size of solid components and excessive water in a heat generating composition are made within appropriate ranges, heat generation is achieved without removal of water using a water-absorptive material or the like after molding, molding property, shape-holding property and exothermic characteristic are able to be highly maintained and a warming effect is achieved for a long period.

Thus, a heat generating composition of the invention is as mentioned in claim 1 that, in a heat generating composition which generates heat by contacting with air, a heat generating composition which is characterized in that an exothermic substance, a reaction promoter, water and a carbon component are essential components, water mobility value thereof is 5 to 15, maximum particle size of water-insoluble solid components excluding the reaction promoter and water is 1 mm or less where 80% or more thereof has a particle size of 300  $\mu\text{m}$  or less, water in the heat generating composition does not

Fig. 19 is an illustrative view showing a method for measurement of water mobility value in the invention.

Fig. 20 is an illustrative view showing a method for measurement of water mobility value in the invention.

#### Best Mode for Carrying Out the Invention

The heat generating composition of the invention is a heat generating composition where particle size of water-insoluble solid components except a reaction promoter and water is made a predetermined value or less, excessive water having 5 to 15 water mobility value is contained, shape of a layered substance molded by molding such as molding by passing a die, molding by stuffing and molding by casting is maintained and generation of heat is made possible without removal of water such as water absorption and dehydration using a substrate material after the molding. Accordingly, it is not necessary to make a container bag water-absorptive but a heat generating body is able to be prepared by receiving a non-water-absorptive container bag.

Thus, in the heat generating composition of the invention, water is used as a binder and the components are bonded by surface tension of water existing among the components whereby fluidity, molding property, shape-holding property and exothermic characteristic are highly maintained and that is entirely different from the conventional viscous heat

promoter and water in the heat generating composition is made as small as possible and that particles are held by means of surface tension by excessive water.

The heat generating composition has been developed as a result of a conclusion that, in order to result in the exothermic reaction, it is better that the excessive water is to be removed as much as possible and, when the excessive water is made as little as possible, heat generation is able to be started efficiently.

Thus, the heat generating composition of the invention is that, in a heat generating composition which generates heat by contacting to the air, an exothermic substance, a reaction promoter, water and a carbon component are essential components, water mobility value thereof is 5 to 15 and maximum particle size of water-insoluble solid components excluding the reaction promoter and water is 1 mm or less where 80% or more thereof has a particle size of 300  $\mu\text{m}$  or less to give a heat generating composition having a molding property whereby particle size of water-insoluble solid components and excessive water are adjusted to within appropriate ranges, molding property and shape-holding property are very good, layering by means of molding by passing through a mold, molding by stuffing, slip casting, etc. is easy, heat generating body of an ultra-thin type to a thick type is able to be manufactured at a high speed, the heat generating composition is able to



the layered product was not resulted, mixing of crumbled pieces of the layered product at the sealed part 6 was not noted and there was no poor seal provided that seal was conducted completely.

Gas-permeability of the covering material in terms of moisture permeability was  $400 \text{ g/m}^2 \cdot 24 \text{ hr}$ .

The heat generating body was received in a non-gas-permeable outer bag by tightly sealing and allowed to stand at room temperature for 24 hours. After 24 hours, it was taken out from the outer bag and an exothermic test was conducted whereupon temperature reached not lower than  $36^\circ\text{C}$  within 1 minute and time for maintaining the heat generation was as long as 8 hours.

#### Industrial Applicability

1) In a heat generating composition of the invention, an exothermic substance, a reaction promoter, water and a carbon component are essential components, water mobility value thereof is 5 to 15, maximum particle size of water-insoluble solid components excluding the reaction promoter and water is 1 mm or less and 80% or more thereof has a particles size of  $300 \mu\text{m}$  or less whereby its molding property, shape-holding property and exothermic characteristic are excellent and, accordingly, it is possible to provide a heat generating body having an excellent exothermic characteristic

## Claims

1. In a heat generating composition which generates heat by contacting with air, a heat generating composition which is characterized in that an exothermic substance, a reaction promoter, water and a carbon component are essential components, water mobility value thereof is 5 to 15, maximum particle size of water-insoluble solid components excluding the reaction promoter and water is 1 mm or less where 80% or more thereof has a particle size of 300  $\mu\text{m}$  or less, water in the heat generating composition does not function as a barrier layer and exothermic reaction takes place when contacted to the air.

2. The heat generating composition according to claim 1, wherein particle size of all of the above water-insoluble solid components is 300  $\mu\text{m}$  or less.

3. The heat generating composition according to claim 1, wherein the heat generating composition uses a heat generating composition having a water mobility value of 7 or more as a material and water content is adjusted by a non-oxidative gas.

4. The heat generating composition according to claim 1, wherein the heat generating composition contains at least one member selected from additional components consisting of water-retaining agent, water-absorptive polymer, hydrogen formation inhibitor, pH adjusting agent, surfactant,